



KANSAS
River Reservoirs Flood and Sediment
STUDY

Final Watershed Study Report
Recommendations Priority List



**US Army Corps
of Engineers.**



The watershed study team investigated water resource issues and opportunities in the Kansas River Basin and recommend comprehensive, long-term solutions based on a shared vision for the basin. The study presents current findings and recommendations for future efforts, including potential future projects and studies in which U.S. Army Corps of Engineers (USACE) could partner with the State of Kansas, sister Federal agencies, and non-Federal entities. The study makes near-term and long-term recommendations. The watershed study integrated water and related land resource management considerations, seeking sustainable water resource management, and making additional considerations. Ultimately, the watershed study informs multiple stakeholders and decision makers at all levels of government and provides a strategic roadmap toward future investment decisions by multiple agencies. Significant need and opportunities exist in the areas of flood risk management, water supply availability and sustainment, and related purposes, such as ecosystem restoration, water quality, sediment management, and recreation. This integrated watershed study focuses attention on significant objectives and tradeoffs, accounts for uncertainty, and promotes adaptive management, stakeholder collaboration, and systems analysis for watershed-scale planning and evaluation.

Developed in collaboration with federal and state agencies, community/local governments and groups, and stakeholders, the watershed study incorporates the best available scientific literature and robust stakeholder engagement across local and federal partners. This collaboration between partners and stakeholders was a critical aspect of the study and played a crucial role in shaping the outcomes.

This watershed study report is not a project implementation document. The level of detail is at a scale adequate for making watershed-level resource assessments and recommendations. Specific projects identified for potential implementation under existing authorities of USACE (e.g., review of existing projects for sediment management) require separate interim reports to specify project features, include detailed engineering information, and appropriate National Environmental Policy Act documentation.

The prioritized list of recommendations addresses the problems, explores the opportunities, and meets the study objectives. This watershed study can be used with other relevant studies and efforts to initiate further studies or projects meeting the priorities and greatest needs in the basin.

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Immediate Actions

Immediate and near-term actions address stressors with high risk and low implementation uncertainty. These should be pursued as soon as possible and within ten years. Immediate actions may require some level of analysis to appropriately implement the measure in the basin.

Table 1 through Table 4 include immediate (near-term) actions shown as flood risk, reduced ability to meet water supply demands, degraded and poor water quality, and ecosystem degradation and species impacts recommendations.

Table 1. Flood Risk Recommendations-Immediate Actions

Focus	Recommendation	Potential Partners and Funding
Lower Kansas River Basin Master Manual and/or Individual Reservoir Project Water Control Manual (WCM) Update	Initiate spin-off studies to update the Lower Kansas River Basin Master Manual or individual reservoir project WCMs within the Kansas River Basin for Tuttle Creek, Perry, Clinton, and Milford.	Estimated Cost: \$--\$\$ Potential Funding: USACE WCM Updates Other Potential Partners/Stakeholders: USACE, KWO, KDWP, KDA, KDHE NDNR, NGPC, USBR Priority Area(s): USACE Reservoirs
Flood Risk Feasibility Studies	Support existing proposals and new requests for flood risk management projects.	Estimated Cost: \$\$ Potential Funding: USACE, City of Topeka, Kansas Other Potential Partners/Stakeholders: USACE, City of Topeka, Kansas Priority Area(s): Shunganunga Creek, Topeka, Lawrence, Junction City, Manhattan, Shawnee, Edwardsville, and Muncie, Kansas

Table 2. Reduction in Ability to Meet Water Supply Demands Recommendations-Immediate Actions

Focus	Recommendation	Potential Partners and Funding
Modification of Low Flow Target Values to Extend Periods of Low Flow Support	Initiate spin-off studies to update the Lower Kansas River Basin Master Manual or individual reservoir project WCMs within the Kansas River Basin (Tuttle Creek, Perry, Clinton, and Milford) Include modification of the low flow target values to extend the period of low flow support during extended drought periods.	Estimated Cost: \$--\$\$ Potential Funding: USACE WCM Updates Other Potential Partners/Stakeholders: USACE, KWO, KRWAD No. 1, KDWP, KDA, KDHE NDNR, NGPC, USBR Priority Area(s): USACE Reservoirs
Tuttle Creek Water Injection Dredging (WID) Demonstration	Initiate a spin-off study to perform a WID Demonstration at Tuttle Creek Reservoir to assess the effectiveness of WID technology at a range of downstream discharges, pool elevations, and in-reservoir locations for potential long-term implementation. Monitor and evaluate both operational effectiveness and environmental results.	Estimated Cost: \$\$ Potential Funding: USACE, KWO Other Potential Partners/Stakeholders: USACE, KWO Priority Area(s): Tuttle Creek Reservoir
Tuttle Creek Reservoir Long-Term Sediment Management Plan	Initiate a spin-off study to investigate sediment management alternatives for the perpetual sustainment of Tuttle Creek Reservoir's authorized purposes and benefits. Lessen negative impacts on the upstream and downstream reaches. Include analysis of technologies to create a long-term recommended plan that supports sustainability of reservoir storage.	Estimated Cost: \$\$ Potential Funding: USACE, KWO Other Potential Partners/Stakeholders: KDWP, KDHE Priority Area(s): Tuttle Creek Reservoir, Lower Big Blue HUC 8 watershed

Focus	Recommendation	Potential Partners and Funding
Kanopolis Reservoir Long-Term Sediment Management Plan	Initiate a spin-off study to investigate sediment management alternatives for the perpetual sustainment of Kanopolis Dam reservoir's authorized purposes and benefits. Lessen negative impacts on the upstream and downstream reaches. Include analysis of technologies to create a long-term recommended plan that supports sustainability of reservoir storage.	Estimated Cost: \$\$ Potential Funding: USACE, KWO Other Potential Partners/Stakeholders: KDWP, KDHE Priority Area(s): Kanopolis Dam reservoir, Middle Smoky Hill HUC 8 watershed
Regional Sediment Management Plans	Conduct a USACE Planning Assistance to States Study to prepare sediment management plans for multiple watersheds in the basin.	Estimated Cost: \$ Potential Funding: USACE PAS, USACE R&D, USACE RSM, KWO Other Potential Partners/Stakeholders: WRAPS, Watershed Districts, Conservation Districts Priority Area(s): Lower Republican, Big Blue, Delaware, Lower Kansas HUC 8 watersheds
Promote Water Conservation Measures	The State of Kansas currently has Water Conservation Plans for each Rural Water District. Updates to water conservation plan guidelines are necessary to ensure all communities and rural water districts have current water conservation and drought management plans.	Estimated Cost: \$ Potential Funding: KWO, KDA Other Potential Partners/Stakeholders: RWDs Priority Area(s): Basin-wide
Promote and Incentivize the Adoption of Watershed Practices	Continue to promote and support adoption of watershed practices to support water quantity and quality (streambank stabilization, improved soil health, increased riparian vegetation and forest wetlands, cover crops, not till farming practices). Success measures should be developed for practices to determine effectiveness. Many good examples of programs in the watershed already exist (WRAPS, RCPP).	Estimated Cost: \$--\$\$ Potential Funding: Other Potential Partners/Stakeholders: WRAPS, KDHE, NRCS, KWO, KDWP, KDA, Tribes, private companies Priority Area(s): Lower Republican, Big Blue, Delaware, Lower Kansas HUC 8 watersheds
Drought Communication and Outreach	Conduct drought simulation exercises to educate the public and identify gaps in conservation efforts. Incorporate drought simulation efforts into state hazard planning. Seek funding and support for efforts from federal partners.	Estimated Cost: \$ Potential Funding: KWO Other Potential Partners/Stakeholders: KDEM Priority Area(s): Basin-wide

Table 3. Degraded and Poor Water Quality Recommendations-Immediate Actions

Focus	Recommendation	Potential Partners and Funding
Promote and Incentivize the Adoption of Watershed Practices	Continue to promote and support adoption of watershed practices to support water quantity and quality (streambank stabilization, improved	Estimated Cost: \$--\$\$ Potential Funding: Other Potential Partners/Stakeholders: WRAPS,

Focus	Recommendation	Potential Partners and Funding
	soil health, increased riparian vegetation and forest wetlands, cover crops, no till farming practices). Develop success measures for practices to determine effectiveness. Many good examples of programs in the watershed already exist (WRAPS, RCPP).	KDHE, NRCS, KWO, KDWP, KDA, Tribes, private companies Priority Area(s): Lower Republican, Big Blue, Delaware, Lower Kansas HUC 8 watersheds

Table 4. Ecosystem Degradation and Species Impacts-Immediate Actions

Focus	Recommendation	Potential Partners and Funding
Support existing plans to Construct and Maintain Wetlands and Rehabilitate Old Oxbows	Support existing proposals and requests for ecosystem restoration projects. Current projects listed on USACE's new start list for GI, CAP, or conversion include Smoky Hill River GI, Jersey Creek GI, Rocky Ford GI, and Harlan County CAP Section 1135.	Estimated Cost: \$-\$\$ Potential Funding: USACE, City of Salina, Kansas, KDWP, Unified Government of Wyandotte County, Kansas, NGPC Other Potential Partners/Stakeholders: Priority Area(s): Smoky Hill River, Salina, Kansas; Jersey Creek, Wyandotte County, Kansas; Rock Ford; Harlan County Reservoir
Consideration and Evaluation of the Kansas River Sustainable Rivers Project	Implement ecological flow proposals to better mimic natural hydrologic regimes and habitat formation developed from the Kansas River Sustainable Rivers Project and continue to refine and adjust these releases as appropriate (adjustments for wet and dry cycles). Monitor the effectiveness of SRP implementation on riverine species reproduction. Recruitment is needed to determine success. Develop adaptive management measures for further implementation.	Estimated Cost: \$ Potential Funding: USACE Other Potential Partners/Stakeholders: USACE, KDWP, KWO, Kansas River Sustainable Rivers Team Priority Area(s): Kansas River mainstem
Biological Monitoring/ Surveying Needs	Monitor reintroduced populations to determine success and inform adaptive management for future efforts.	Estimated Cost: \$\$ Potential Funding: USACE, KDWP Other Potential Partners/Stakeholders: NGPC Priority Area(s): Basin-wide
Invasive/Non-native Species Management (Kansas RPA)	Install watercraft inspection and decontamination stations near federal reservoirs. Continue to request funding through the Kansas State Water Plan Fund for the KDWP ANS management and control.	Estimated Cost: \$ Potential Funding: USACE, KDWP Other Potential Partners/Stakeholders: USBR Priority Area(s): Federal Reservoirs

Focus	Recommendation	Potential Partners and Funding
Lake Level Management Plans	Conduct a comprehensive review of LLMPs and the review process and implementation. Greater flexibility and local control are desired to utilize LLMPs more effectively. The SRP E-pools work is currently supporting these efforts.	Estimated Cost: \$ Potential Funding: USACE, KWO, KDWP Other Potential Partners/Stakeholders: USACE, KWO, KDWP Priority Area(s): USACE Reservoirs in the Kansas River Basin

Immediate Evaluation Options/Fill Data Gaps

Problems deemed appropriate for evaluating options in the near-term are those with high risk and moderate levels of implementation uncertainty. Additional studies are needed to better understand the problem and identify recommended plans. Studies should be initiated in the near-term, ideally within five years, and target implementation should happen between five to ten years. To address problems requiring a more detailed understanding of the problem, recommendations should be categorized as filling data gaps before initiating a study or project. These data gaps should be resolved in the near-term (0 to 5 years) with initiation of a study or implementation of a program taken in incremental steps (five to ten years or sooner, if possible).

Table 5 through Table 9 include immediate (near-term) evaluation options and fill data gaps shown as flood risk, reduced ability to meet water supply demands, degraded and poor water quality, ecosystem degradation and species impacts, and loss of recreational opportunities recommendations.

Table 5. Flood Risk Recommendations-Immediate Evaluations and Fill Data Gaps

Focus	Recommendation	Potential Partners and Funding
Missouri River Control Point Modification	Initiate a spin-off study to evaluate modification to control point (Waverly gage) operations for the Kansas River Basin. Recommend a spin-off USACE project to update the WCMs. It would allow for greater flexibility during extreme and high events and quicker evacuation of flood storage at the reservoirs. It would decrease the risk of surcharge releases, and possible downstream flooding along the Kansas River and tributaries caused by surcharge releases.	Estimated Cost: \$ Potential Funding: USACE WCM Updates Other Potential Partners/Stakeholders: KWO, KDWP, KDA, KDHE Priority Area(s): Milford, Tuttle Creek, Perry, and Clinton Reservoirs

Table 6. Reduction in Ability to Meet Water Supply Demands Recommendations-Immediate Evaluations and Fill Data Gaps

Focus	Recommendation	Potential Partners and Funding
Water Supply Demand Study	Determine future water supply demands in the Lower Big Blue, Lower Republican, Delaware, Upper Kanas, Middle Kansas, and Lower	Estimated Cost: \$ Potential Funding: USACE PAS, KWO Other Potential

Focus	Recommendation	Potential Partners and Funding
	Kansas HUC 8 watersheds.	Partners/Stakeholders: Priority Area(s): Lower Big Blue, Lower Republican, Delaware, Upper Kanas, Middle Kansas, and Lower Kansas HUC 8 watersheds.
Bank Stabilization/ Stabilize Head-cuts	Identify bank stabilization sites, expansion of head-cut assessments, and potential project sites Include hydraulic modeling to determine appropriate design features for maximum performance and cost effectiveness.	Estimated Cost: \$ Potential Funding: USACE, KDWP, KWO, WRAPS SLT Other Potential Partners/Stakeholders: Priority Area(s): WRAPS Priority Areas, Lower Big Blue, Lower Republican, Delaware, and Lower Kansas HUC 8 watersheds
Kansas River Alluvial Model	Develop a stream aquifer model of the Kansas River Alluvial Aquifer for Junction City, Kansas, to the junction with the Missouri River to examine the effect of scenarios of future development and management of groundwater and river water levels.	Estimated Cost: \$ Potential Funding: KWO, Kansas Geological Survey (KGS) Other Potential Partners/Stakeholders: USGS Priority Area(s): Kansas River mainstem
Kansas Research Priorities Support	Support reservoir research priorities developed by the Kansas Water Research Coordination Group. USACE Kansas City District (NWK) and KWO recently entered into a PAS Study that provides an opportunity to work together on Kansas reservoir research priorities, utilizing expertise from state agencies, universities, and USACE. Pooled funding is used to support these efforts. Kansas will continue to look for opportunities to work with USACE on similar efforts.	Estimated Cost: \$ Potential Funding: USACE PAS, USACE R&D, USACE RSM, KWO Other Potential Partners/Stakeholders: KDHE, KGS, KBS Priority Area(s): Basin-wide

Table 7. Degraded and Poor Water Quality Recommendations-Immediate Evaluations and Fill Data Gaps

Focus	Recommendation	Potential Partners and Funding
Operational Strategies for HAB Management in Inland Reservoirs	Conduct systematic study of the influence of USACE reservoir control options on HABs. Investigate the effectiveness of water level management and releases to address HABs in reservoirs.	Estimated Cost: \$ Potential Funding: USACE PAS, USACE research and development (R&D), State of Kansas Programs Other Potential Partners/Stakeholders: USACE, KDHE, KWO Priority Area(s): Milford Reservoir

Table 8. Ecosystem Degradation and Species Impacts Recommendations-Immediate Evaluations and Fill Data Gaps

Focus	Recommendation	Potential Partners and Funding
Removal of Stream Impediments and Fish Barriers	Identify sites in the Lower Big Blue, Lower Republican, Delaware, and Lower Kansas HUC 8 watersheds for potential ecosystem restoration projects. Remove existing man-made or natural stream impediments and fish barriers.	<p>Estimated Cost: \$\$</p> <p>Potential Funding: USACE CAP Section 206</p> <p>Other Potential Partners/Stakeholders: KDWP, Ducks Unlimited, TNC</p> <p>Priority Area(s): Lower Big Blue, Lower Republican, Delaware, and Lower Kansas HUC 8 Watersheds</p>
Upstream Floodplain Ecosystem Restoration	Identify sites in the Lower Big Blue, Lower Republican, Delaware, and Lower Kansas HUC 8 watersheds for potential ecosystem restoration projects that induce deposition on upstream floodplains in composition with grade control (stage zero projects). These would be multipurpose projects providing ecological habitat benefits, sediment reduction to downstream waters, reduction of water quantity and water quality concerns, and reduction of ongoing streambank erosion and head-cuts.	<p>Estimated Cost: \$\$</p> <p>Potential Funding: USACE, KWO, KDWP, Ducks Unlimited, TNC, WRAPS</p> <p>Other Potential Partners/Stakeholders: Conservation Districts</p> <p>Priority Area(s): Lower Big Blue, Lower Republican, Delaware, and Lower Kansas HUC 8 watersheds</p>
Reintroduction of Imperiled Species	Develop habitat suitability requirements and site evaluation methods to identify sites and segments for potential reintroduction of imperiled species. Include establishment of safe harbor agreements and candidate conservation agreements with willing landowners to reintroduce imperiled species on their property.	<p>Estimated Cost: \$</p> <p>Potential Funding: USACE, KDWP</p> <p>Other Potential Partners/Stakeholders: USFWS</p> <p>Priority Area(s):</p>
Riparian Corridor Restoration	Identify sites in the Lower Big Blue, Lower Republican, Delaware, and Lower Kansas HUC 8 watersheds for potential ecosystem restoration projects that focus on riparian habitat restoration. These would be multipurpose projects that provide ecological habitat benefits, sediment reduction to downstream waters (reservoirs), reduction of water quantity and water quality concerns, and reduction of ongoing streambank erosion and head-cuts.	<p>Estimated Cost: \$\$</p> <p>Potential Funding: USACE, KDWP, Ducks Unlimited</p> <p>Other Potential Partners/Stakeholders: KWO, TNC, WRAPS, Conservation Districts</p> <p>Priority Area(s): Lower Big Blue, Lower Republican, Delaware, and Lower Kansas HUC 8 watersheds</p>
Western Streams Baseflow Monitoring	Initiate a spin-off study to monitor baseflow in streams in western Kansas. This would provide a baseline to monitor future reductions in stream	<p>Estimated Cost: \$</p> <p>Potential Funding: KWO, KDWP, KDHE</p>

Focus	Recommendation	Potential Partners and Funding
	baseflow in the future.	Other Potential Partners/Stakeholders: USACE, USGS Priority Area(s): western Kansas streams

Table 9. Loss of Recreational Opportunities Recommendations-Immediate Evaluations and Fill Data Gaps

Focus	Recommendation	Potential Partners and Funding
Expansion and Improvement of Visitation Data	Collaboration between USACE and KDWP to develop a central storage location for visitor and visitation data, allowing for better sharing between state and federal agencies.	Estimated Cost: \$ Potential Funding: USACE, KDWP Other Potential Partners/Stakeholders: USBR Priority Area(s): Basin-wide

Potential for Federal Interest

The potential for federal interest in risk reduction measures and strategies benefiting multiple areas in the basin is promising with many measures being multipurpose. The problems and issues addressed exist throughout the basin. Recommendations solving the problems and issues related to the reduction in ability to meet water supply demands, degraded or poor water quality, and loss of recreation opportunities also provide benefits for flood risk and ecosystem restoration and support solutions having comprehensive benefits.

Recommendations not only include efforts accomplished from partnering with state and local partners on civil works studies, but USACE can also provide inter-agency support to sister Federal agencies, like the U.S. Bureau of Reclamation, Environmental Protection Agency, Federal Emergency Management Agency, or U.S. Department of Agriculture to assist with water resource projects for which USACE has expertise, but is not the appropriate lead agency, as needed and requested.

Recommendations to address water resource problems and opportunities require intentional action and a substantial investment of time and funding by Federal, State, and local entities. The challenges of studying, planning, and implementing a suite of projects of the magnitude for the basin requires that projects are implemented in phases, based on where the needs are most urgent and where there is consensus and support for implementation among State, regional, and local groups; Tribes; and the Federal government.

The State of Kansas is committed, in partnership with stakeholders, local and regional groups, Tribes, and the Federal government, to continue making investments in water resources infrastructure, innovation, and research. The most recent state legislative bill passed fully funds the Kansas State Water Plan and represents a significant increase in funding to protect essential water resources. The bill funds technical assistance supporting municipalities and other units (i.e., watershed districts), provides water project grant funds for construction and upgrades to water infrastructure projects, and funding for high priority water projects in the state.

Several of the recommendations for the watershed study including collaboration between the State of Kansas and USACE Kansas City District (NWK) were initiated during the development of recommendations. These include:

Tuttle Creek Reservoir Water Injection Dredging Demonstration—NWK and the KWO received funding to conduct the Tuttle Creek Reservoir Water Injection Demonstration to assess the effectiveness of the technology for potential long-term sediment management at the reservoir. The study is ongoing and is in the planning phase with an expected timeframe of 2025 for conducting the demonstration at Tuttle Creek Reservoir. Following the demonstration, an assessment will be conducted to determine the effectiveness of the technology and the parameters for operations that would optimize long-term use of water injection dredging.

USACE Water Control Manual Updates—NWK was appropriated funding to update WCMs for the seven USACE reservoirs in the basin (Milford, Tuttle Creek, Perry, Clinton, Wilson, Kanopolis, and Harlan County reservoirs). These updates are being conducted in phases starting with updates to the WCMs for reservoirs on the lower Kansas River (i.e., Milford, Tuttle Creek, Perry, and Clinton reservoirs). Updates for the remaining three reservoirs are expected to begin within the next year. The updates will include an evaluation of the water control rules for reservoir storage or release of water and potential measures for improvement. The updates will bring drought contingency plans up to date and update content and historic data. The manual update process includes exploring more efficient methods of managing water storage and releases where possible through analysis of the existing controlling criteria and developing and analyzing alternatives to the existing plan.

Smoky Hill River Ecosystem Restoration Feasibility Study—USACE and the City of Salina, Kansas, are working together on a feasibility study to develop a plan for ecosystem restoration on the Smoky Hill River. The study, initiated under the USACE CAP 1135 Program, was recommended for conversion to a USACE General Investigation Feasibility Study because of the higher level of funding needed to support the preferred plan for ecosystem restoration. The project is ecosystem focused and includes restoration of aquatic habitat functions and features within and near the old Smoky Hill River channel that were lost due to the flood risk management project. Restoration measures include reconnection of the old channel, improvements to base flow, aquatic connectivity and habitat functions, wetland and riparian habitats, and whole system functions. The Smoky Hill River Ecosystem Restoration Feasibility Study was selected under the General Investigation Program as a new start study. The study is expected to start in 2024.

Harlan County Reservoir Ecosystem Restoration CAP 1135—A Feasibility Study conducted by NWK in partnership with the Nebraska Game and Park Commission was approved in 2020. Funding was received in 2023 to begin design and implementation for the project to restore habitat at the reservoir in Methodist Cove. The design phase was completed with construction of the project currently occurring.

Silver Jackets Project Related to Flood Risk and Healthy Watersheds—Silver Jackets coordinated with the Kansas Department of Health and Environment on the Kansas Healthy Watershed Study. The project evaluated the benefit of watershed-wide

land use incentives supporting the U.S. Department of Agriculture Natural Resource Conservation Service soil health management systems and reducing downstream flood flows. The study evaluates the benefits of no-till and cover crop practices for reducing flood risk by looking at soil related infiltration rates to better represent long-term soil practices in hydrologic analysis. Soldier Creek watershed was selected for the first study. The findings of this effort were integrated into the state hazard mitigation plan. An ongoing spin-off to this effort is a cost-effective analysis to compare improved soil health versus a structures approach.

Kansas Research Priorities Support—In February 2023, the Kansas Water Office and NWK entered into a Planning Assistance to States Agreement providing the agencies the opportunity to work together on Kansas reservoir research priorities utilizing expertise from state agencies, universities, and USACE. The current study supports current and future water availability and sustainment and water quality through researching and monitoring water sustainability, watershed erosion prevention, HABs, and flood and geomorphic hazard mapping. The State is conducting monitoring and modeling of the Kansas River Alluvial Aquifer that supports recommendations to examine the effects of scenarios of future development and management of groundwater and river water levels. Additional bathymetry studies are being conducted to provide the most recent forecasting of reservoir conditions and the team is looking at other potential techniques for sediment management in reservoirs. Streambank stabilization effectiveness is being evaluated and headcut identification in the basin will be conducted. Research related to Harmful Algal Blooms will be done and identification of potential areas where riparian wetland complexes could be proposed. Some of the work is being conducted under a Cooperative Ecosystems Unit agreement that assesses the economics of reservoir sedimentation and sustainability at three of the reservoirs in the basin that are projected to have the high sedimentation in the future (Tuttle Creek, Kanopolis, and Perry reservoirs). The work also includes locating low-head dams and estimating the sediment contribution that a breach would have on downstream reservoirs. Additionally, the agreement allows for creation of an automated method and tool for locating headcuts and application of this method in the basin. These studies pool resources to support these efforts and support numerous recommendations for the watershed study.

Muncie Bluff–Armourdale Watershed Assessment—The Unified Government of Wyandotte County and Kansas City, Kansas, and NWK entered into a Planning Assistance to States Agreement that investigates the Muncie Bluff and Armourdale watersheds to compile data for the enclosed system to cover existing data gaps to gain a better understanding of flooding behind USACE levees and to identify solutions and capital investment needs. The study area includes large tracts with disadvantaged communities. The study area is one of those identified by the flood risk assessment (Appendix H) as having a high risk for life safety and property damages if flood events of a certain magnitude occur (0.1 percent Annual Exceedance Probability, 0.02 percent Annual Exceedance Probability). There has been substantial riverine flooding within these watersheds with frequent flooding in many historic areas.

Support of the Kansas River Sustainable Rivers Project—NWK and The Nature Conservancy are working with Kansas state agencies and stakeholders to continue

ongoing work on the Kansas River Sustainable Rivers Project to develop an implementation and monitoring plan for proposed environmental flows from USACE reservoirs that would benefit downstream ecology on the Kansas River mainstem. Other ongoing efforts include looking at pool level management measures supporting existing or new plans to promote and improve in-reservoir habitat for fish, waterfowl, migratory birds, and other wildlife that utilize reservoir habitat.

These new initiatives are in addition to the many ongoing efforts by State, regional, local, Tribal, and Federal entities discussed in the watershed study. Existing authorities and programs will be utilized, when possible, to implement recommendations.

It is critical that State, regional, local, Tribal, and Federal entities work together to strategically plan and implement the needed projects in order to promote efficiency and effectiveness, and to take advantage of synergies, where possible.

Recommendations that have not been initiated and considered a high priority with a potential federal interest with USACE NWK include:

Tuttle Creek Reservoir Long-Term Sediment Management Plan—NWK and the Kansas Water Office have made a request for a new start general investigation. The study authority proposed is Section 216 of the Flood Control Act of 1970 that authorizes the Secretary of the Army to review the operation of completed projects that were constructed by the USACE in the interest of navigation, flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions.

The purpose of the study is to recommend a sediment management alternative for the perpetual sustainment of Tuttle Creek Reservoir authorized purposes and benefits and the lessening of negative impacts on the upstream and downstream reaches. This study will include sufficient analysis of these technologies to create a long-term recommended plan, including costs, National Economic Development benefits, dam safety evaluations, and National Environmental Policy Act. Ecological lift will be described sufficient for National Environmental Policy Act, but not in quantified habitat units. Costs and effectiveness for the hydraulic dredging measures will be informed by recent lake dredging performed at nearby John Redmond Lake, Kansas. This project will utilize the Existing Conditions and Future without Project information that have been generated by the Kansas River Reservoir Flood and Sediment Study. This project will meet the recommendation by the Environmental Advisory Board that the USACE implement reservoir sediment sustainability pilot projects that demonstrate different management options. This can also be used to satisfy the requirement in Water Resources Development Act 2016 Section 112 for reservoir sediment management pilot projects. The recommended plan may include up front capital costs as well as repeated sediment management operations to be performed annually or continuously.

Kanopolis Reservoir Long-Term Sediment Management Plan—The study authority proposed is Section 216 of the Flood Control Act of 1970 that authorizes the Secretary of the Army to review the operation of completed projects that were constructed by the USACE in the interest of flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions.

The purpose of the study is to recommend a sediment management alternative for the perpetual sustainment of Kanopolis Reservoir authorized purposes and benefits and the lessening of negative impacts on the upstream and downstream reaches. This study will include sufficient analysis of these technologies to create a long-term recommended plan, including costs, National Economic Development benefits, dam safety evaluations, and National Environmental Policy Act. Ecological lift will be described sufficient for National Environmental Policy Act, but not in quantified habitat units. Costs and effectiveness for the hydraulic dredging measures will be informed by recent lake dredging performed at nearby John Redmond Lake, Kansas. This project will utilize the Existing Conditions and Future without Project information that have been generated by the Kansas River Reservoir Flood and Sediment Study. This project will meet the recommendation by the Environmental Advisory Board that the Corps implement reservoir sediment sustainability pilot projects that demonstrate different management options. This can also be used to satisfy the requirement in Water Resources Development Act 2016 Section 112 for reservoir sediment management pilot projects. The recommended plan may include up front capital costs as well as repeated sediment management operations to be performed annually or continuously.

Perry Reservoir Long-Term Sediment Management Plan—The study authority proposed is Section 216 of the Flood Control Act of 1970 that authorizes the Secretary of the Army to review the operation of completed projects that were constructed by the USACE in the interest of flood control, water supply, and related purposes, when found advisable due to significantly changed physical or economic conditions.

The purpose of the study is to recommend a sediment management alternative for the perpetual sustainment of Perry Reservoir authorized purposes and benefits and the lessening of negative impacts on the upstream and downstream reaches. This study will include sufficient analysis of these technologies to create a long-term recommended plan, including costs, National Economic Development benefits, dam safety evaluations, and National Environmental Policy Act. Ecological lift will be described sufficient for National Environmental Policy Act, but not in quantified habitat units. Costs and effectiveness for the hydraulic dredging measures will be informed by recent lake dredging performed at nearby John Redmond Lake, Kansas. This project will utilize the Existing Conditions and Future without Project information that have been generated by the Kansas River Reservoir Flood and Sediment Study. This project will meet the recommendation by the Environmental Advisory Board that the Corps implement reservoir sediment sustainability pilot projects that demonstrate different management options. This can also be used to satisfy the requirement in Water Resources Development Act 2016 Section 112 for reservoir sediment management pilot projects. The recommended plan may include up front capital costs as well as repeated sediment management operations to be performed annually or continuously.

Kansas Water Plan Strategic Planning Coordination—The State of Kansas was directly by Governor Laura Kelly to develop a strategic plan to develop a long-term implementation and funding strategy for the five guiding principles identified in the 2022 Water Plan Update. These include securing the state's reservoirs and improving water quality. USACE NWK is working with the Kansas Water Office to develop a scope of

work for a new Planning Assistance to States to support the actions to support the strategic plan.

Kansas Reservoirs Sustainment and Sedimentation—The State of Kansas has formally requested collaboration with the USACE NWK and Tulsa District to begin discussions with Kansas Water Office related to USACE reservoir sedimentation and sustainability in the form of an official working group or task force. This effort was initiated in January 2024 with the first efforts ongoing to determine a framework for this effort. One of the main goals for the State of Kansas includes development of a sediment management strategy for all USACE reservoirs in Kansas that provide water supply. NWK and USACE Tulsa District are working with Kansas Water Office to develop a scope of work for a new Planning Assistance to States to support the actions identified in the framework. Ongoing support is needed through Planning Assistance to States studies and other authorities (General Investigations) to support this effort.

Jersey Creek Ecosystem Restoration Feasibility Study—NWK and the Unified Government of Wyandotte County and Kansas City, Kansas have made a request for a new start general investigation. Jersey Creek is a major waterway in Kansas City, Kansas, and has long been in a degraded condition due to previous flood control measures which lined the channel with concrete. The proposed project intends to remove the existing concrete channel along an approximately 1.6-mile long reach of the creek and construct a channel in a natural condition, providing aquatic ecosystem restoration. This study would take a comprehensive approach to properly account for historic modifications and changing future conditions to ensure identification of sustainable ecosystem restoration solutions for Jersey Creek. The study is waiting on new start authority and appropriation.

Rocky Ford Ecosystem Restoration Feasibility Study—NWK and the Kansas Department of Wildlife and Parks have made a request for a new start general investigation for ecosystem restoration of Rocky Ford. Approximately 10 miles of the Big Blue River from Tuttle Creek Dam to the confluence with the Kansas River have been highly altered from previous USACE projects and non-Federal projects. Impediments on the Big Blue River impact native species migrating from the Kansas River such as the Blue Sucker, a Kansas Species in Need of Conservation. Tuttle Creek Dam operations have altered natural flows in the lower Big Blue River, resulting in changed water quality parameters such as cooler water temperatures, and altered seasonal flows that species use as queues to migration. Loss of habitat quantity and quality has in turn detrimentally impacted aquatic species numbers, diversity, and condition. The study would investigate alternatives for ecosystem restoration. The study is waiting on new start authority and appropriation.

Shunganunga Creek, Topeka, Kansas Feasibility Study—USACE and the City of Topeka, Kansas, are working together on a feasibility study to develop a plan for flood risk management on Shunganunga Creek. The study, initiated under the USACE Continuing Authorities Program 205 Program, was recommended for conversion to a USACE General Investigation Feasibility Study because of the higher level of funding needed to support a plan for flood risk management. Based on results of the Section 205 Continuing Authorities Program study, five areas were identified for flood risk

management consisting of levees, channel modifications, and non-structural measures. The study is waiting on new start authority and appropriation.

Silver Jackets Project Related to Flood Risk Mitigation—Silver Jackets is including several new proposals to support the areas/communities that were identified in the watershed study as potential high flood risk in the future. New proposals include projects that are watershed based, flood forecasting, and benefit/cost analyses useful for grant applications with any federal agency:

- *Manhattan Urban Watershed*—This project evaluates open space for detention storage of severe repetitive flooding and see if cumulative effects of Natural and Nature-Based Features help reduce flooding and supporting new city standards. This would emphasize green measures (green infrastructure, green space, Natural and Nature-Based Features, urban waters, etc.) and includes assessment and site planning and public awareness.
- *Catchment Hydrology and Healthy Soils*—This project evaluates hydrology (including climate change rainfall) sensitivity to infiltration from Soil Health Management Systems, shares responsibility via effective watershed-level General Plans to land incentives for the Soil Health Management Systems, identifies monitoring opportunities for infiltration, develops collaboration with the Natural Resource Conservation Service, U.S. Environmental Protection Agency, and Federal Emergency Management Agency Direct Technical Assistance, and advocates education watershed use of these Natural and Nature-Based Features. The study provides planning support for the Kansas Department of Agriculture Division of Conservation and Kansas Department of Health and Environment, hydrologic model sensitivity analysis, and economic analysis, and communication/outreach products.
- *Edwardsville Flood Forecast Inundation Maps*—This project establishes a flood warning tool and inundation maps that protect life safety for current flooding through a collaboration locally with 4 federal agencies. This aids the communities of the Unified Government and Edwardsville. The project will include a hydraulic model, static map book, a communication product webpage (National Weather Service National Water Prediction Service), and outreach.
- *Junction City Flood Forecast Inundation Maps*—This project establishes a flood warning tool and inundation maps that protect life safety for current flooding through a collaboration locally with 4 federal agencies. This aids the community of Junction City. The project will include a hydraulic model, static map book, a communication product webpage (National Weather Service National Water Prediction Service), and outreach.
- *Shunganunga Flood Forecast Inundation Maps*—This project establishes a flood warning tool and inundation maps that protect life safety for current flooding through a collaboration locally with 4 federal agencies. This aids the community of Topeka, KS. The project will include a hydraulic model, static map book, a communication product webpage (National Weather Service National Water Prediction Service), and outreach.

- *Edwardsville Benefit/Cost Analysis*—This project assists the community in benefit/cost analysis for the 1 percent Annual Exceedance Probability for climate change for acquiring properties for buyouts and using new land as Natural and Nature-Based Features. The project will include a hydraulic model and economic assessment report.
- *Wakarusa Greenway Evaluation*— This project evaluates the flood damages or loss avoidance for community changed zoning for Natural and Nature-Based Features in the Greenway, including the 1 percent and 0.2 percent annual exceedance probabilities for current and future climate change conditions. The project also provides Flood Forecast Inundation Mapping, as development and public understanding is very much needed. The project includes a report identifying flood losses prevented and summarizing future flood consequences if old zoning is allowed to proceed and will be contrasted to improved zoning by the county and city, perhaps in support of a stream or river setback ordinance as key nonstructural tools in managing the flood risks. Report will also summarize habitat assessment for floodplain (if local requests), as well as the affected cultural resources.

Additional Considerations

The federal reservoirs and their associated multipurpose storage, owned and operated by USACE in the Kansas River Basin, provide substantial economic benefits to the local, regional, and national economy from water supply, recreation, fish and wildlife, and water quality. The Kansas River Basin USACE reservoirs serve as a critical drinking water supply for more than 600,000 people in addition to being used for irrigation, municipal wastewater and industrial discharges, and power generation. There are significant water resource challenges that must be met over the short- and long-term in the Kansas River Basin. The federal reservoirs operated by USACE have been asked to meet the multipurpose needs and values of today's modern society, including an increased demand for flood risk management benefits to large and small communities, recreation facilities, agricultural areas, an increased demand on water supply, a changing climate, and an increased societal value on protecting and restoring the ecosystem.

Recommendations of the watershed study include those necessary to increase the resiliency and sustainability of the system. The study identifies viable opportunities for investment in critical infrastructure throughout the basin, including the existing reservoirs, to increase their resiliency to provide for water availability and sustainment, ecosystem restoration, water quality, and recreational amenities. With the projected increased demands for the Kansas River basin, potential for more variable future conditions, potential for higher temperatures, winds, higher reservoir evaporation rates, and uncertainty in future drought frequencies, there is a critical need to implement actions to maintain reservoir storage capacities and increase future water supply security.

The sponsors believe there is shared local and federal interest in improving long-term management of the reservoirs to better sustain the valuable multipurpose storage created with federal authority and funding. Currently, water supply use in USACE

reservoirs and sustainment of that storage is a 100 percent local, non-federal partner responsibility. The sustainment of water supply investment that USACE makes available is a matter of Federal interest and could be raised to a level similar to flood risk and navigation. Water supply sources are critical to supporting life and economic activity in the region and the nation, and when considering growing future water supply needs and increasing acute challenges, the sustainment of resources developed under federal authority are strongly in the federal interest. Future water supply in the Kansas River Basin is threatened by loss of multipurpose pool storage in USACE reservoirs and will have high economic, social, and environmental risks. Elevating water supply to a threat level comparable to flood risk is warranted to meet the multipurpose needs and values of today's society.

The State of Kansas established a funding stream and is dedicated to the development of additional funding to support future reservoir sustainability strategies and USACE has an opportunity to partner with the state in evaluating methods to extend the useable lifetimes of USACE projects. The Kansas Legislature invested a substantial amount of state general funds to shore up public water supply programs and the State Water Plan Fund, for investment in water studies and projects. The Kansas Water Office advises they are ready, willing, and able to pursue cost-shared efforts toward in-lake reservoir sediment management, both for research and development and/or for project implementation.

This consideration could also support creation of a new authority allowing dredging or other measures applied to federal reservoirs for the purpose of long-term sustainment of the multipurpose pool and its use for water supply and other purposes that are about sustainment of life and economic development affecting the economy regionally and nationally. USACE should take a broader federal interest in reservoir sediment management similar to sediment management currently ongoing to coastal ports and harbors.

Research and Development

The State of Kansas also requests consideration of new or a Continuing Authorities Program that, through the newly established Research and Development account, provides a mechanism for cost sharing with the federal government and non-federal sponsors on research and development (R&D) projects including R&D related to reservoir sustainability and reservoir sediment management. Also, provisions should be made to allow for research and development projects to be components of feasibility studies where that would be useful and viable.

Infrastructure Operations and Maintenance

Water infrastructure in Kansas including dams, levees, reservoirs, treatment plants, distribution lines, etc., were mostly developed 50 to 60 years ago and a large percentage of the facilities need upgrade, repair, or replacement. Reservoirs are filling with sediment, reducing the ability to store multipurpose pool storage and capture flood waters, and many levees and dams may already be unable to provide the desired or needed level of public safety protection. Significant critical infrastructure including water and wastewater treatment plants, power plants, fire stations, schools, and military installation facilities are located downstream of the reservoirs. Sustaining the ability of

federal and state infrastructure projects (or operations) to provide these risk reduction benefits for this infrastructure into the future is crucial as replacement of these facilities with the benefits they provide is for the most part cost prohibitive.

Underfunding of routine operations and maintenance budgets at USACE reservoirs presents significant economic, flood, and environmental risks to areas in the Kansas River Basin. It is anticipated that for flood risk management, future funding of routine operations and maintenance activities at some Kansas River Basin reservoirs will be less than the amount requested which could lead to a reduction in the ability to fully address the impacts caused by aging components, sedimentation and erosion, and the ability to provide the current level of service. The same issue applies to other purposes and sustainment of reservoir multipurpose benefits as a whole.

Additional Recommendations

Based on the additional considerations the following recommendations are included for consideration in the future.

- Elevate water supply to a priority equivalent to flood risk management and navigation because future water supply needs are growing and challenges in meeting those needs, and the critical nature of water supply in supporting and sustaining life and economic development, continue to mount.
- Establish more flexible and efficient collaboration mechanisms and authorities for USACE to partner with state and other agencies to leverage resources to sustain the water resources benefits provided by USACE reservoirs and other projects where applicable.
- Establish or expand authority or policy to allow for projects at USACE lakes to reduce sediment accumulation for multiple beneficial purposes.

Topic	Recommendation	Authority	Appropriation	Estimated Start Date	Non-federal Partner
Tuttle Creek Reservoir Long-Term Sediment Management Plan	Initiate a new start study to investigate sediment management alternatives for the perpetual sustainment of Tuttle Creek Reservoir's authorized purposes and benefits. Include analysis of technologies to create a long-term recommended plan that supports sustainability of reservoir storage.	Section 216 of the Flood Control Act of 1970	General Investigation New Start	FY2025	Kansas Water Office
Kanopolis Reservoir Long-Term Sediment Management Plan	Initiate a new start study to investigate sediment management alternatives for the perpetual sustainment of Kanopolis Dam reservoir's authorized purposes and benefits. Include analysis of technologies to create a long-term recommended plan that supports sustainability of reservoir storage.	Section 216 of the Flood Control Act of 1970	General Investigation New Start	FY2025	Kansas Water Office
Perry Reservoir Long-Term Sediment Management Plan	Initiate a new start study to investigate sediment management alternatives for the perpetual sustainment of Perry Dam reservoir's authorized purposes and benefits. Include analysis of technologies to create a long-term recommended plan that supports sustainability of reservoir storage.	Section 216 of the Flood Control Act of 1970	General Investigation New Start	FY2026	Kansas Water Office

Topic	Recommendation	Authority	Appropriation	Estimated Start Date	Non-federal Partner
Kansas Water Plan Strategic Planning Coordination	Development of a strategic plan to develop a long-term implementation and funding strategy for the five guiding principles identified in the 2022 Water Plan Update. These include securing the state's reservoirs and improving water quality.	Section 22 of WRDA 1974, as amended (42 U.S.C. 1962d-16)	Planning Assistance to States Program Funding	FY2024	Kansas Water Office
Kansas Reservoirs Sustainment and Sedimentation	Development of a sediment management strategy for all USACE reservoirs in Kansas that provide water supply.	Section 22 of WRDA 1974, as amended (42 U.S.C. 1962d-16)	Planning Assistance to States Program Funding	FY2024	Kansas Water Office
Jersey Creek Ecosystem Restoration Feasibility Study	Initiate a new start study to investigate ecosystem restoration of Jersey Creek. The proposed project intends to remove the existing concrete channel along a reach of the creek and construct a channel in a natural condition, providing aquatic ecosystem restoration. This study would take a comprehensive approach to properly account for historic modifications and changing future conditions to ensure identification of sustainable ecosystem restoration solutions for Jersey Creek.	Section 216 of the Flood Control Act of 1970	General Investigation New Start	FY2025	Unified Government of Wyandotte County and Kansas City, Kansas

Topic	Recommendation	Authority	Appropriation	Estimated Start Date	Non-federal Partner
Rocky Ford Ecosystem Restoration Feasibility Study	Initiate a new start study to investigate ecosystem restoration of Rocky Ford. Approximately 10 miles of the Big Blue River from Tuttle Creek Dam to the confluence with the Kansas River have been highly altered from previous USACE projects and non-Federal projects. The study would investigate alternatives for ecosystem restoration.	Section 216 of the Flood Control Act of 1970	General Investigation New Start	FY2025	Kansas Department of Wildlife and Parks
Shunganunga Creek, Topeka, Kansas Feasibility Study	Initiate a new start study to investigate flood risk reduction in Topeka, Kansas along Shunganunga Creek. The study, initiated under the USACE Continuing Authorities Program 205 Program, was recommended for conversion to a USACE General Investigation Feasibility Study because of the higher level of funding needed to support a plan for flood risk management.	Section 216 of the Flood Control Act of 1970	General Investigation New Start	FY2025	City of Topeka, Kansas
Silver Jackets Project Related to Flood Risk Mitigation	Silver Jackets is including several new proposals to support the areas/communities that were identified in the watershed study as potential high flood risk in the future. Current Proposals Include: Manhattan Urban Watershed Evaluation; Healthy Soils and Catchment Hydrology; Edwardsville Flood Forecast Inundation Maps; Junction City Flood Forecast Inundation Maps; Shunganunga Creek Flood Forecast Inundation Maps; Edwardsville Benefit/Cost Analysis for Buyouts; Wakarusa River Greenway Evaluation	Floodplain Management Services	Annual Program Funding	FY2024	Various